

# HannaH - Technical Document

## v0.4

### Document Versioning

Version	Changes	Changed on	Changed by	Approved by
0.1	Genesis	06.06.2022	Management	Kreshnik Hasanaj
0.2	Insert infrastructure link	08.06.2022	Management	Kreshnik Hasanaj
0.3	Setup natural language processing	11.06.2022	Management	Kreshnik Hasanaj
0.4	Additional explanation on system architecture	16.06.2022	Management	Kreshnik Hasanaj

### Glossary

Term	Meaning
NLP	Natural language processing
P2P	Peer to Peer
AES	The Advanced Encryption Standard
HTTPS	Hypertext Transfer Protocol Secure

<b>SSL</b>	Secure Sockets Layer (SSL)
<b>SSH</b>	The Secure Shell Protocol (SSH)
<b>VPC</b>	Virtual Private Cloud

# Table of Contents

Document Versioning	1
Glossary	1
<b>Table of Contents</b>	<b>3</b>
<b>Introduction</b>	<b>4</b>
<b>Natural language processing (NLP)</b>	<b>4</b>
Utterance	5
Automatic Speech Recognition	5
Natural-language understanding	6
Execute Actions	6
Natural Language Generation	7
Fulfilment	7
<b>System Architecture</b>	<b>8</b>
Components	8
User	8
Device	8
P2P Network	9
Firewall and Loadbalancers	9
API Cluster	10
Database Cluster	10
Caching Cluster	11
<b>GDPR Compliance</b>	<b>12</b>
Access control	12
Encryption and data protection	12
<b>References</b>	<b>13</b>

# Introduction

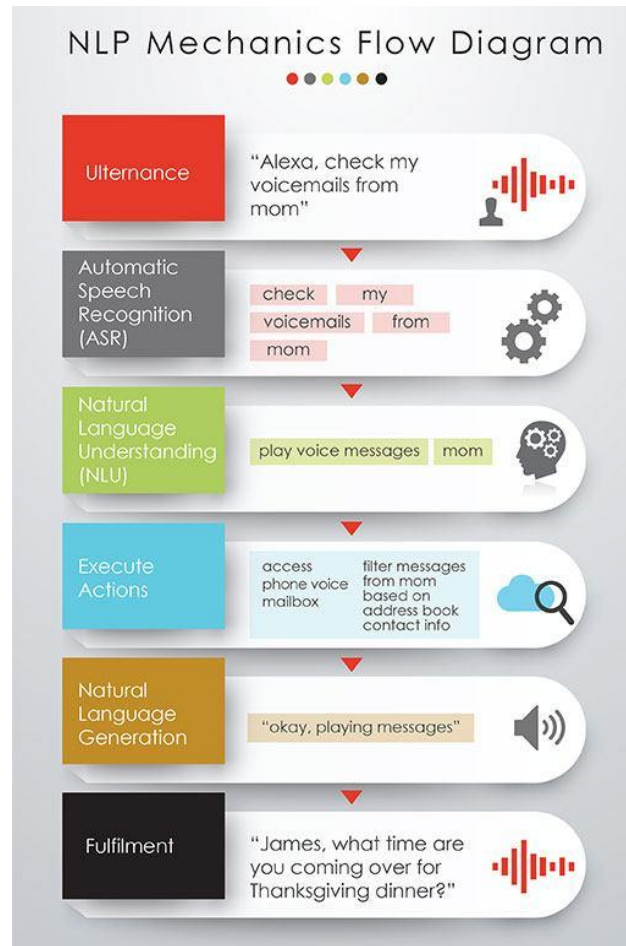
This document aims to provide an high level understanding of the technical requirements for HannaH.

## Natural language processing (NLP)

Natural language processing (NLP) is the ability of a computer program to understand human language as it is spoken and written -- referred to as natural language.

For HannaH to accomplish matchmaking, it must first understand human language and the underlying action/intent of the user.

We propose the following NLP flow to accomplish the above.



## Utterance

Anything that a user says is an utterance.

For example - *"HannaH I want to speak to someone."*

## Automatic Speech Recognition

Automatic Speech Recognition or ASR, as it's known in short, is the technology that allows human beings to use their voices to speak with a computer interface in a way that, in its most sophisticated variations, resembles normal human conversation.

In our example, it is recognizing each fragment in the utterance individually.

*HannaH I want to speak to someone*

## Natural-language understanding

Natural language understanding is a branch of artificial intelligence that uses computer software to understand input in the form of sentences using text or speech.

NLU enables human-computer interaction. It is the comprehension of human languages such as English, Spanish and French, for example, that allows computers to understand commands without the formalized syntax of computer languages. NLU also enables computers to communicate back to humans in their own languages.

In our example, it is the understanding of the interaction that the user wants to perform.

Automatic Speech Recognition	Natural-language understanding
HannaH I want to speak to someone	Find people available to speak to Ana

## Execute Actions

These are the actions that users want to execute. In simple words, intents are the intentions of the user that you can draw from the utterances.

In most cases, intents can be identified by looking for verbs in the dialogues of the users. But sometimes the complete sentence is used to determine its intent of it.

In the given sentence, the user wants to talk to someone.

*"HannaH I want to speak to someone."*

This translates into the following actions to be performed by the HannaH

1. Find people who are online
2. Perform matchmaking based on available parameters
3. Generate speech to ask users for availability to talk with Ana
4. Execute generated speech
5. Listen for a response from user
6. Perform NLP on the given response
7. Determine if the response is positive
8. If positive generate speech to introduce the participant to Ana

9. If positive set up a P2P connection between both users
10. If negative let other users know about the availability of Ana
11. Perform hot-word detection for additional actions to be performed

## Natural Language Generation

Natural language generation (NLG) is a software process that produces natural language output. In one of the most widely-cited survey of NLG methods, NLG is characterized as "the subfield of artificial intelligence and computational linguistics that is concerned with the construction of computer systems than can produce understandable texts in English or other human languages from some underlying non-linguistic representation of information".

For example - *"Hello Peter, Ana is currently looking for someone to chat with, would you like to be connected?"*

## Fulfilment

deals with connecting both users, making the chat between both participants possible.

# System Architecture

This section aims to provide insights into the system architecture for HannaH.

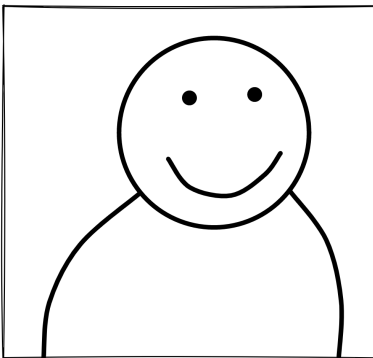
The following link provides a high-level visual overview of HannaH's system infrastructure and the individual components.

**Link:** <https://app.excalidraw.com/l/98IT6cN2yuw/8eesS6J8dd5>

## Components

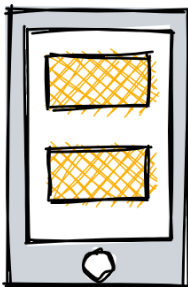
### *User*

A user is someone that interacts with HannaH



### *Device*

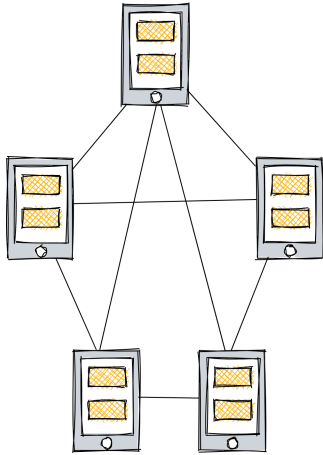
The device is a medium through which the user can interact with HannaH.





## *P2P Network*

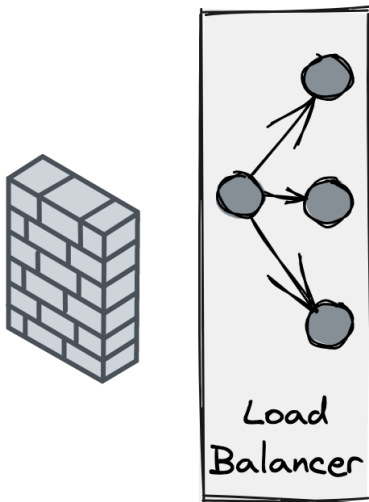
The P2P network<sup>[1]</sup> is created between two users when they want to chat.



## *Firewall and Loadbalancers*

Firewalls will protect against outside cyber attackers by shielding the servers or network from malicious or unnecessary network traffic.

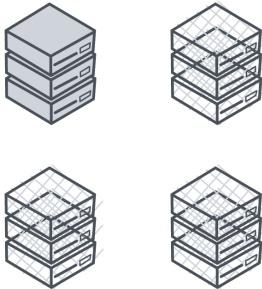
Load balancers will improve the availability and responsiveness of different system components and prevent servers from overload.



## *API Cluster*

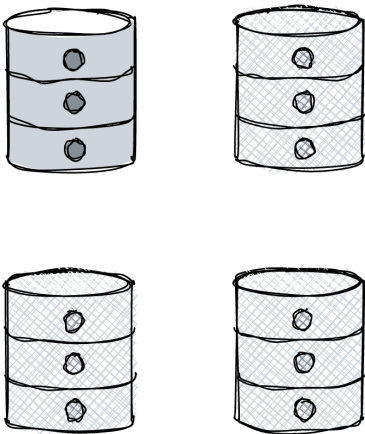
The API cluster will be responsible for performing tasks such as;

1. Performing match-making among users
2. Encrypting sensitive user data
3. Storing and retrieving user preferences
4. Populating the caching system with frequently used data
5. Etc



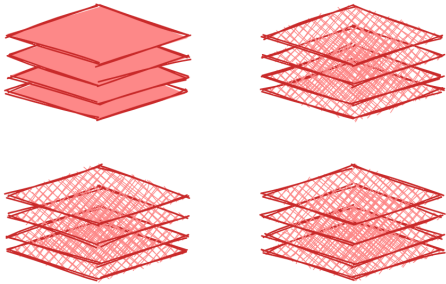
## *Database Cluster*

The database cluster is a collection of databases that are managed by a single instance of a running database server. User preferences as well as other settings will be stored in these database instances.



## *Caching Cluster*

The purpose of the cache cluster is to store frequently used data so that the waiting time is as low as possible for each user.



# GDPR Compliance

## Access control

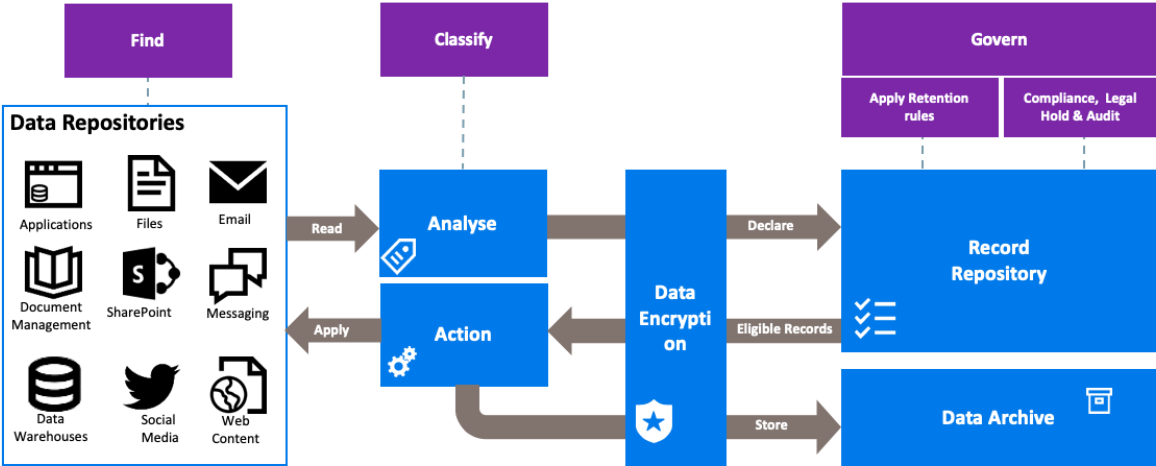
To keep access to personal data in control, the engineering team will grant only core members access to the production environment through public-key authentication (SSH). While a staging environment will mimic the production environment, it will not host any sensitive user details.

## Encryption and data protection

All data transmitted to the server or from the server will use AES. Additionally, all encrypted values that are persisted in the database are encrypted using OpenSSL and the AES-256-CBC cipher. Furthermore, all encrypted values are signed with a message authentication code (MAC). The integrated message authentication code will prevent the decryption of any values that have been tampered with by malicious users.

We aim to use the GDPR readiness architecture as a state-of-the-art reference for the software development process.

**GDPR readiness reference architecture**



# References

[1] <https://en.wikipedia.org/wiki/Peer-to-peer>